URL: https://ecorner.stanford.edu/videos/from-conviction-to-company-entire-talk/

Michelle Lee is the founder and CEO of Medra, which combines recent advances in robotics and computer vision to build lab automation technology. She has previously worked at NVIDIA, SpaceX, and McKinsey. Prior to founding Medra, Lee was an assistant professor in computer science and electrical computer engineering at New York University. In this presentation and conversation with Stanford adjunct lecturer Ravi Belani, Lee explains why she decided to start her deep tech company and uses her experiences to give advice to aspiring founders.

Transcript

(upbeat music) - Welcome Stanford and broader communities 00:00:18,330 to the Entrepreneurial Thought Leader seminar here at Stanford University. ETL as you all know, is a Stanford seminar for aspiring entrepreneurs and is presented by STVP, the Stanford Engineering Entrepreneurship Center and BASES, the Business Association of Stanford Entrepreneurial Students. I am Ravi Belani, a lecturer in the management Science and Engineering department at Stanford and the director of Alchemist and Accelerator for enterprise startups. Today we are thrilled to welcome Michelle Lee to ETL. This is a true full circle moment for Michelle. She was literally in your seats like less than a decade ago. Michelle is the CEO and co-founder of Medra, which is building robots to accelerate scientific breakthroughs. The company enables scientists to automate lab tasks and focus on making groundbreaking scientific discoveries. Now, Michelle was born and raised in Taiwan and then came to the United States for high school, which began a pattern in Michelle's life of jumping into new territories and completely excelling. From high school, she went on to join to come to Stanford and she's a Cardinal three times over.

She graduated in 2015 with a bachelor's degree in chemical engineering and as an undergrad threw herself into the robotics club even though she didn't have any prior experience from high school in robots. She then goes on to get a Master's degree in a completely different discipline at Stanford in mechanical engineering and she graduates as a Mayfield Fellow in Tau Beta Pi. And then while at Stanford, she also is doing internships at McKinsey, SpaceX and Nvidia and then goes to get a PhD at Stanford in the computer science lab in the mechanical engineering department as part of the Stanford AI lab and literally in computer science, in her PhD program, in her first year is the first time that she learns Python, and yet she completes her PhD in three years and then goes on to get a tenured faculty track position in computer science at NYUA, a dream job for many. But she resigns from that dream job to go into yet another new domain of entrepreneurship because she was so compelled by the conviction that she had around Medra. And so today we're going to explore those themes around conviction, deep tech entrepreneurship, and understanding your path in life. And so with that, please welcome Michelle. So lots of ETL love for you Michelle. - Awesome, thank you so much Ravi, 00:02:52,830 for that great introduction. And this totally feels surreal because like Ravi just said, I finished my PhD in 2021, so I have literally taken so many classes in that auditorium. So it feels really great to be back for ETL and I've taken ETL before too, so this is very exciting to be back.

So as Ravi said, I would love to kind of show, do a really quick presentation to just give a sense of where I have been and what Medra is all about. There will be robots involved, so that's why I think presentation mode just makes a lot of sense. So

really quickly, let me just share my screen here so you can actually see. So yeah, hey everyone, I'm Michelle and I am a roboticist, that is me in the Stanford AI lab just playing around with robots, which I love. As Ravi mentioned, I did my PhD in the computer science department at SAIL, even though my degree formally is in mechanical engineering. And if I had to describe my research during my PhD, it's really at the intersection of robotics, machine learning and computer vision. And for those who don't have like a robotics background, let me just show you an example of what that looks like. So this was a research project that I did where we taught this robot how to wipe a whiteboard just by training it like with data, like just by saying, "Hey, can you train over and over in simulation to learn how to wipe things and we'll reward you if you are successful," and was able to kind of train them unto then in the real world and if you guys wanna see again to be able to wipe this whiteboard directly from data. So I do wanna kind of fast forward a little bit to at the end of my PhD to talk about a decision that I was making. So I want to transport you guys to 2021.

I am wrapping up my PhD at Stanford in AI and I am offered to start my own robotics research lab with almost $1 million in funding to start out, which curiously is very similar to what some investors were offering if I wanted to start my own company. So I had a choice here. Two very different paths I can take. On one hand it's academia, which is a million dollars in funding, no strings attached, and complete freedom to work on whatever I want to work on, right? So that's academia, on the other hand, it's starting my own company. So I would get about three quarters of that funding compared to academia. So less money here in exchange for equity for this company. So, hmm, strings attached with this money. And I would probably have to dedicate the next decade of my life on one single problem. So, hmm, no freedom to choose what I really want to do. But I would get one very exciting thing that really inspired me and that is scale and the chance to really impact and change lives.

So on the one hand, academic freedom and on the other hand a chance to change lives at scale. So spoiler alert, I'm here right now at ETL, so you know what choice I made. I chose scale and I founded Medra. So Medra is helping scientists and biologists with the same struggle and the same dilemma I faced in 2021, which is how do you take really impactful research and how do you scale it to something that can actually change lives? So I want you guys to again, imagine you are a scientist and many of you guys are, I want you to imagine you're a biologist, you just made a major discovery in your lab that you can synthesize something called mRNA, which can create proteins in a cell, but you don't have any proof about how mRNA can actually be useful or maybe it can be turned into a drug and the only way to get that proof is to do lots of experiments. It's pipetting, it's moving test tubes around, it's sorting your samples in ice, it's more pipetting just over and over again. So when mRNA was synthesized in the labs in the 1980s, researchers were already dreaming of its therapeutic potential, but it took decades before mRNA could be commercialized into a vaccine we all know very well, the mRNA COVID vaccine. So almost 40 years from research breakthrough to scaled up impact that can actually change lives. So what if instead of asking our very brilliant and highly trained scientists, instead of asking them to pipette day in, day out, we could just automate it with robots. So let me just show you some examples of what our robots can do. Robots can run experiments overnight over weekends.

Robots don't really get bored and tired of repetitive menial tasks. Robots certainly don't get repetitive strain injury, which is like a real problem for biologists, when they're pipetting day in day out. Robots can 10x the experimental throughput and accelerate our drug discovery process. And this potential extends beyond drugs to even plastic devouring microbes that can clean up our oceans. We can even have the robots to come up with new lab grown meat, which can replace factory farms that's creating so much greenhouse gas and maybe even combat really complex diseases and mechanisms like aging and be able to work on really exciting work in longevity. So like the thing that I want you to imagine is if every biotech and pharma company out there had 10 or even 20 of these me robots doing experiments for them and generating data, if scientists can now just focus on science instead of the monotony of repetitive manual bench work, imagine if the next generation of biotech companies, the future Modernas of the world, were going to create groundbreaking medicine with our robots, instead of taking four decades to come up with, go from a research discovery to a real drug, it takes them a year. That's the scale that inspired me to start med DRA in the first place. And that's the reason I chose this path that I am on right now. And that is to build robotics to accelerate scientific breakthroughs. And today I'm really excited to be having this fire side chat with Ravi and also to talk to you guys about how you can also find your passion and convictions in life.

For you, it might not be scale, maybe it's something else. Maybe it is doing fundamental scientific discovery in academia, but it's something that you have to choose for yourself. So that's a little bit more about me, a little bit more about Medra, and I'm excited to kind of go in and talk more about more things with Ravi and also with all of you. Thanks a lot. - Thank you Michelle. 00:11:05,910 Michelle, that was very inspiring. I can understand why you're doing what you're doing, but I wanted to double click and dive in on this idea of actually building conviction towards an idea that you decide to dedicate your one precious life to just because I know all the students just like yourself have a flurry of options and it's one thing to conceptually understanding and inspiring an idea and it's another thing to actually take action. And it's even another thing even more to take action when you're giving up such a treasured job that I think many people would've spent their lives pursuing to get a tenured track job in New York City in computer science. And so it's a different thing when you have to say no to that. So I wanted to first dive into really adding color on that inflection moment of decision where you're saying no and you're resigning from the job of the NYU tenure track job and you're saying yes to Medra.

Can you give us more color on that? Was that a difficult time or was it pretty easy in your mind to make the decision and can you add more color on exactly what was happening in those moments and how you made the decision? - Those are great questions Ravi. 00:12:19,610 And I think for me, when I made that decision, it was not difficult. But if you had to go back six months ago, I actually really struggled with that decision. I actually had a VC come to me because they knew I had this tenure

track job and I basically had told NYU, "Look, I wanna start a company. Can I take a year before starting a company to kind of, before I start as a professor?" And so six months before I actually made that decision to resign, I actually had a VC tell me like, "Why are you even trying to start a company while also trying to become a professor?" And they had told me this thing which is like, "As a startup founder, you should burn all bridges and burn all bridges behind you burn all ships so you have nowhere to go but ahead. And so by having this option of becoming a professor, that actually will make you less successful as a founder." And I really struggled with that because the truth was six months before I resigned from my faculty position, I didn't have full conviction with what I was doing at Medra, I was still exploring. And so it took a while to gain that conviction. Took about six months of exploration to gain that conviction. Once I did have that conviction, it was a very simple decision to make. And I think that question of like how do we gain conviction is a better way of thinking of it than instead of framing it as optionality versus commitment.

I think in Silicon Valley there's a lot of this conversation against optionality and Peter Thiel talks about how life is not a portfolio, an entrepreneur cannot diversify themselves. But I actually think optionality allows you to explore sometimes and explore different options. And if you're intentional about your exploration, instead of just chasing out the optionality for the sake of optionality, if you're intentional about the exploration, you can actually use that as a way to gain conviction towards the path you wanna take. - That was great and can we talk about though 00:14:51,510 that moment when you actually got conviction in terms of what was the criteria or the necessary conditions for you to suddenly binarily shift and have conviction? - Yeah. 00:15:06,150 or not their idea is good enough to actually have a, and I think there's two convictions or sort of the conviction of time when you actually decide to focus your time on it. And then there's the conviction where you know that the company's gonna succeed and maybe we're not there yet, but for that first conviction moment, when you a, after six months when you had the conviction to then dedicate your time, what happened? What unlocked at that moment to give you conviction? - So I think the truth is 00:15:32,493 conviction is gonna look different for every single person. And so the question you have to ask yourself is what is a thing that will make me feel conviction? 'Cause that's gonna look different. I actually talked with a founder who said, "Look, I didn't really have conviction about what I'm building until I raised money." And again, VCs might think, "Oh well you should have a conviction about your idea because you believe in it." But for her it was about the economic safety of it. So everyone's source of conviction is gonna look different. For me, there were a couple things.

The first was I wanted to work on something robotics related because I'm passionate and just a total nerd about robotics. So I knew that about myself. The second thing though was I wanted to work on something where I knew it was gonna have a huge impact and that's why I chose the space of biology, which is what I explained earlier. But the third part was for me the conviction that I needed to see was people really desperately needed what I was gonna build. Like it actually is going to make a difference. There is a market here for what I'm going to build. And so for that, for Medra, I actually sold a robotic system to a customer before I even started building the product. I actually made a sales pitch deck. And I wasn't trying to like pretend I had a product, I went out there very clearly saying to people, "I don't have a product yet. I know what I need to build, I know how to build it.

This is what I'm gonna build. I just wanna know, is this gonna be helpful for you? Can you tell me?" And a company said, "Yes, that would be very helpful. In fact, it would be so helpful, we would love to work with you and sign a contract with you." And that was the moment that convinced me, wow, that this is something I'm building that people actually want, that they're willing to pay for it before I even started building anything, I just have a PowerPoint presentation. So that was the thing that convinced me. - That's fantastic actually. 00:17:45,000 So I just want everybody to note that, that the conviction moment happened when, there's a couple things, but it was, the measurement could have been just getting a signed contract, not with even the product built, but just the pain point and the vision validated with the signed contract, the pain point and the vision before you even built the product. I have a bias on this. I think you should never make a decision based on venture capitalists. I do think it should come from internal or customers, but fair enough, each to their own on coming up with conviction. But yeah, that, that's fantastic.

I know I'm gonna have limited time Michelle and there's lots that I wanna discuss. But one thing that I think you're just a singularity in is leveling up and then becoming an expert in completely new areas. You shift from mechanical engineering to mechanical, oh sorry, from chemical engineering to mechanical engineering. Then you start learning computer science in your first year of your PhD and you complete that in three years and then get a tenure track computer science faculty position. And you have this history of going into new areas very quickly, leveling up and then dominating, share your secrets. So spill for all the students that are scared about going into new areas and everybody who has imposter syndrome, how do you go into a new area and level up and dominate so quickly and hacks are great. - So I definitely have imposter syndrome first of all. 00:19:10,830 And I think that is one thing that fuels me, right? It is acknowledging, I'm a total beginner in something, acknowledging that I don't know as much and just coming into a space with humility of I don't know anything and I'm here to learn. My brother actually, when I was an undergrad, I actually took a product design class I think, sophomore year and I had no design experience and I'm not very artistic And I remember telling my brother, my older brother, like, "I am like the worst person in this class. I should be taking an engineering class not the design class, I'm the worst person in the class.

It feels so bad to be so bad at something." And my brother actually told me, "When you're the worst person in a room, you're gonna learn the most." And that's the kind of attitude I've always taken since then. Whenever I'm learning something

new, if I am the least knowledgeable person here in this room, then I get to learn the most. I get to grow the most. And so in terms of hacks, really it's being honest with yourself and with others too. Like transparent, like "Hey, I don't know much but I'm here to learn and I'm willing to put in the effort to learn." So when I started my PhD, I would go to people and ask them, "How did you learn how to code? Is there anything I can do? Like what classes would you recommend?" I would be in lab Friday nights and on weekends, right? And I demonstrated I cared deeply about learning. And when people see that they wanna help you, they wanna teach you. And so it's this willingness to say, "I don't know but I want to grow and can you help me grow?" And I think when people see that they actually just really do want to help. - And did you ever have moments when you thought, 00:21:06,537 "I'm just not cut out for this, I made the wrong decision?" - Yeah, I almost quit my PhD when I was studying 00:21:15,990 for my quals, as a PhD student you have to pass your qualification exam, which is a oral exam in front of professors that just ask you questions and I was doing my qualifying exams for mechanical engineering 'cause that's the department I am, but I actually did not take mechanical engineering as an undergrad. So I was teaching myself a lot of the things that I needed to know in order to pass the exams. And there were definitely times that I felt like, oh shoot and like am I in the right place? But again, it's this willingness to then say like, okay, I do need to catch up on things.

I'm gonna be honest with myself. I'm maybe gonna push back my quals a quarter later so I have more time to prepare and I'm gonna dedicate this quarter to really study for, I'm gonna form a study group around me so I have accountability. But there were definitely times I thought that I wanted, like I wasn't cut out. But then it's again, not being caught up on those feelings of inferiority or imposter, but using that as like a, using the curiosity of like, what can I learn here? What can I grow here? Like it's okay if I fail, like as long as I learn, as long as I can become better that, making that the motivation rather than like, am I gonna succeed or not? - That's fantastic, by the way, Sean Anchor 00:22:36,990 who's the Harvard researcher, I think he would completely agree with you, one of the things that we teach and that he teaches is that only 25% of your success is a function of your IQ. 75% is your optimism, your growth mindset, and your social support. So I think you're saying that all in spades, which is terrific. I wanna move now towards talking about deep tech entrepreneurship because it's so rare for us to have somebody who's so bold to go into hardware, robots, which are like oftentimes four letter, these are the equivalent of four letter words that VCs have a religious aversion to for a variety of reasons. And so I want to go through some of the pitfalls with doing a deep tech startup and get your responses or advice. Before we talked about how the way that you got to conviction on your time was with customer validation as one point that a customer signed a contract just with the pain point and the vision without even the product being built. Many robotics companies start that way, but then they end that way too.

They end as just consulting businesses where you basically find one customer or a few customers that really need the product. And because the margins are so low, it becomes a services business that doesn't scale. - Definitely. 00:23:53,940 And if so, can you speak to your thoughts on that? - Yeah, so I think there are two pitfalls I see 00:24:01,980 in a lot of robotics and deep tech companies. The first is what you said, which is how do you actually avoid becoming just another basically venture subsidized consulting firm with really, really smart people. And really what I did was I looked at a lot of robotics companies, some that have succeeded, some that have failed and really work backwards. How did they fail and why did they fail? And the key thing of why robotics companies have failed is because they don't have a technology that can generalize, they can't actually scale up their technology if they want more people to use the system, they basically have to hire more people to kind of do that consulting service. And so when I was thinking about like what can I build at Medra, the first thing I thought is like, is this gonna be scalable and generalizable? And scalability and generalizability is not something you can get day one, it's something that you have to build technology towards. But as a team and a company, we have that in mind of like, how can we actually scale up into something that is going to, is going to be able to help if we have new customers, it's going to take a very minimal amount of time to help them get set up with a new system. But I think a second pitfall I actually see from deep tech companies and robotics company starting out with wanting to just build the technology without knowing what problem you're actually trying to solve.

And maybe even building technology for the sake of building technology. Like, "Wow, wouldn't it be so cool if we have a robot that can do," dot, dot, dot rather than saying, "Is this actually going to solve a problem that's out there?" So for, finding that customer to say, "Hey, I actually really want this." And using that as a north star of like, "Hey, we could build this product that the customers actually really want and really help them solve their problems." That has really guided us to be able to be able to actually build the right thing for our customers. - Okay, that's terrific. 00:26:16,290 So one of the other, I think, quicksand moments for deep tech and hardware companies can be fundraising because oftentimes with software, you can just use your own labor and build a software product that's very scalable, easy to distribute. The marginal cost of software is basically zero. But with hardware it's capital intensive. And so you have oftentimes this conundrum where you need to spend all of your time building product, but to build product you need cash. And then you're spending all of your time trying to get cash, but nobody's gonna give you cash until they've de-risked the product and you never take off because of the capital intensity of that fundraising product initial development cycle. Any thoughts on that, on how to hack that or what founders who want to do hardware should think about which might be different than software founders? - So fundamentally, Medra is actually a software business. 00:27:09,330 We're not actually a hardware business.

And again, that goes back to that scalability question of like, when I started Medra, do I actually think what Medra is doing can actually scale? I think if you're building your own hardware, it is a lot harder to scale because now you have to think about manufacturing and like you said, the capital intensity of that. The reason why I think Metro's a software business is we actually use, industrial robots are off the shelf. The secret weapon and the secret sauce of what we're building is not actually

the physical hardware is the software that powers the robots. And so we're using fairly commoditized industrial robots and we're actually using AI and computer vision and state-of-the-art robotics to be able to power that robot. And I think an analogy I like to use here is like self-driving car companies, their magic sauce is not the car 'cause they can just buy a car, right? And they can put it put cameras and LiDARs on it. Their magic sauce is the algorithm that allows the cars to be able to self-drive. And similarly at Medra, our magic sauce is the software and the algorithms and the AI that powers our robots to be able to automate what our customers want. And so that is really what helps us become able to scale. - That's great, okay. 00:28:36,870 Let me open it up now to the students.

Speaker Hi Michelle, thank you for joining us. 00:28:39,660 At the School of Business, I've noticed there are two different schools of thoughts around entrepreneurship. Some people have advocated that it's important to build expertise first and then use that to find gaps. And then you figure out kind of where to build a business to cover the gaps and others have advocated that, "Hey, if you have the conviction or interest, you can build a team around you and you kind of learn kind of in the process you have other people to kind of supplement your knowledge." Where's sort of your opinion on that spectrum? And can you kind of, in terms of starting a business and if you can share details why. - Yeah, so I think there's something a lot 00:29:15,600 of people talk about product market fit, but there's also something called like the founder market fit and a question of why you, so let's say I was someone without any robotics experience, it would be pretty hard to start Medra because people will say, why me? Now let's say I didn't have robotic experience but I had a great network in robotics. Like maybe I've worked at a robotic company as a operator, right? Then there's a bit more of why me because I now have the necessary components and the competitive advantage to be able to recruit a great team around me. So I think the main thing you would need to ask yourself is sure you can have that passion, you can have that drive, but you still need to create that competitive advantage and it might take a little bit more time and I think every market is going to be different. Now, for me though, also, I did go into robotics or at least the AI part of robotics as a fairly new beginner, but I did then do a PhD in it to become an expert in it. I don't think I could have started Medra without having that expertise of the AI and computer vision. So I think the question is like how can you create that founder market fit to make sure you are the best founder to be addressing this problem or building this product.

- Thank you Michelle, next question. 00:30:52,920 Speaker Thank you very much for your talk, Michelle. 00:30:54,480 My question is, what do you consider to be the most important characteristic and trait of an entrepreneur? - Hmm, that is such a good question. 00:31:08,020 In my opinion, it's the ability to learn and I'm biased because that is the thing that served me so well is the ability to not know something, but like that willingness and the resilience of saying, "Let me become an expert in it." Prior to founding Medra, I didn't have a lot of experience with recruiting, for example, and building a team. But you have to, when you become a founder to recruit a team around you to be able to build a product. And so I was then able to just again, ask people around me, get lots of advice and surround myself with expertise and mentors to be able to learn how to do that. So if you're willing to learn, willing to grow, I think that's one of the best traits to have as a founder. - And any tactics on learning that you wanna share? 00:32:05,070 Either books that you love or just general tactics that you use that may be unintuitive that yeah. - I think I'm very good at asking questions 00:32:20,340 and finding the right people to ask them to and being very strategic about it. So I did an internship at SpaceX where I had only, at that time I had worked on projects in the robotics club and built like this electric go-kart with a team, but I'd only actually officially taken like two classes in mechanical engineering and this was a mechanical engineering internship.

And I just remember being like, "Oh wow, like there are a lot of things I don't know and it's probably gonna be very difficult to figure it out all by myself." And I basically made a list of like, here are all the people who are willing to help me here and have said, hey, they're willing to mentor me. If I ask one person all my questions, they're probably gonna get really annoyed at me and they're probably gonna think that, like I'm not thinking for myself. So I basically would think about what questions I should ask whom, when should I ask them, and also again, demonstrate that I actually am willing to do the work. I'm not just like, every time I have a question, like I won't even think about it, I would actually do the work, put in like half an hour, an hour of work to really think through what the possibilities are and really formulate the right questions. And I really feel like I hit the wall, I then go to someone in the company that's a mentor to be like, "Hey, can you help me with this?" And I think like talking with experts is one of the fastest way to learn, but you have to first do that homework too. You can't just show up to someone with a list of questions and kind of annoy them with it. You have to show to them that you are worth investing their time into. - And what if somebody says, "But I don't have a list 00:34:01,660 of contacts, I don't know a bunch of experts to go and ask questions with. How do I get that list?" - Yeah, I think you need 00:34:09,270 to do that research yourself, right? Like say you wanted to go into robotics and you don't know how to, go search up who are robotics professors around at Stanford that you could talk to. If the professors aren't willing to talk to you, who are their PhD students who have a lot more time on their hand maybe and that maybe they're willing to talk to you, maybe you can't do that, go to someone's office hours.

So like really take it step by step to like build out that network. - That's terrific, that's great, thank you Michelle. 00:34:44,940 Next question, gang. Speaker So Michelle, it sounds 00:34:48,270 like you've been really successful in terms of finding mentors and keeping up those relationships and I was just wondering if you had any advice as to how to keep those connections going long-term and not just have them fizzle out? - That's a really great question. 00:35:07,572 I actually think I actually sometimes struggle with that too. And I don't think there's a easy solution to it. I think in the end you have to, if you wanna build those relationships, you also have to invest in those relationships. But it's also sometimes okay, like totally okay and totally normal to like email someone after not having talked to them for a while and say, "Hey, like, I know we haven't

spoken in months, maybe years, but like, I really wanna reconnect and here's what's going on with me." And again, like assuming that humble attitude of like, "Hey, like I wish I had reached out more but I didn't, but here I'm now trying to reconnect again." - And Michelle, right now, you gave the example 00:35:52,500 of that SpaceX, when you were trying to learn something mechanical and you'd only taken two classes. Now you're in other deep, new water, this like entrepreneurship journey. I don't know if there's things that you're struggling with right now that feel new, but can you share real time, like anything, things that you're wrestling with and how you're using mentors or advisors or finding the support that you weren't necessarily trained in the past to solve new issues that you're trying to deal with now? - So I do think that like I said, 00:36:22,320 asking for help is really important, but you have to show that you're doing that homework yourself.

And one thing that I really recommend folks just thinking about is this concept which has been very popularized by Elon Musk's idea of first principles thinking, really like trying to understand a problem and thinking through the components first and doing that problem solving first to then be able to come up with the solutions. I think also, and I think that that serves me really well when I'm encountering a problem that I haven't faced before, is to really try to like solve that problem out first. And also the other part is really, really embracing the scientific method. And I might be a little biased here because I did do a PhD, so, and that has served me incredibly well too as an entrepreneur, right? Thinking about what is your hypothesis and what are your assumptions, and then being able to go out there to collect evidence, empirical evidence to be able to test that hypothesis out. There are a lot of things out there that honestly, mentors and advisors cannot answer for you because especially as an entrepreneur, your situation is so unique to you, right? And yes, advisors can kind of share their thinking about it, but you cannot as an entrepreneur take their advice wholesale and say, "Let me apply that." And so you do need to also think through again, like be very hypothesis driven and be very empirical about how you solve that problem. - That's great. 00:38:07,890 - I know that sounds very theoretical 00:38:11,130 and I'm trying to think if I can come up with an example here, but maybe Ravi, if you have any questions I can come back to that. - Well, I might dive into this concept then 00:38:24,510 of first principles, is the idea then of this, I think that's actually incredibly powerful because the truth is is that even there's gonna be tons of people that are gonna have advice when you're starting a company and you can also just get mentor whiplash or advice whiplash from people telling you lots of different things. But on this idea of first principles, is it the scientific method? Is it basically just articulating some basic premises of inputs that you think are driving an output and then testing that? Or is there, I don't know if there is an example you can, like are you dealing with that right now with hiring, for example? Is that coming up with issues on the team or is there a tangible example we can show, we can walk through on how you applied first principles? - Okay, so let's take the example 00:39:11,647 of what should my team focus on right now? In the beginning when we started working on these, we had a customer, so they told us exactly what we should be working on. Once we finish that customer, then it's what's next, right? Should we get another customer? Should we be doing R&D? Should we be building A, B or C? And I think that first principle thinking is really thinking first about like what is that goal? What is the goal you're trying to achieve here? And really be able to work backwards from there.

So our goal is to create a product that scales and a product that customers truly want, that really solves their problems, right? That's really our main goal is like we want, I believe if we can solve customers' problems, then we're building something with value. Well then the question is how do we actually figure out what problems to be solving? Let's say we just signed another customer and we built for that customer, but the question is like, maybe that customer just had a very specific need that is not what every other customer wants, right? So then that wouldn't be helpful. So if we really wanted to understand what's going to solve problems for a whole market and a whole field, we have to go talk to people. And so I realized that actually instead of spending my time doing more engineering work and trying to maybe build for new customers or like building what we think would be really cool, I just need to go out there and talk with scientists, talk with biologists, talk with founders of biotech companies and really understand like, what do you actually need and can we help you with that? And what should, and maybe figuring out like are there clusters of things where we see there's like a huge need in, so we can really focus our time and energy on that. Another example here would be, oh, or Ravi, I don't wanna keep going. - No keep going, these are great, this is great. 00:41:25,590 - Okay. 00:41:38,130 The minimal viable product, the first time people ever used it. And so there's going to be problems with it, right? And so we're now like supporting our customers and trying to fix all the problems. And a question comes up of like, hmm, what should we be focusing on? Should we again try to get another customer? Should we try to make it easier to have new customers or should we try to really support our current customers? And one tool that you can use when you're doing first principles thinking is to really think about things taken at extreme, right? Like let's say we focused on making it really fast to scale our product right now.

Like so every new customer and maybe it takes like two weeks to be able to set up a new robot for them. Well if you take it to the extreme and say let's now deploy hundreds of robots like every two weeks, we're gonna deploy 100 robots, but support actually takes us, let's say 10 engineers, right? I'm just exaggerating here. Then our company absolutely cannot scale because just 'cause it's fast. We can have hundreds of robots out there, but now for every robot we need 10 engineers to be able to support, right? So taking that extreme, it was very clear to us that as a team we actually needed to focus on support now and build out all that infrastructure for support to be able to help us scale our product. - That's super helpful and I love the extreme example too. 00:43:01,473 That makes it a lot more tangible. Michelle, I'm curious 'cause even that first thread kicked off in my head, this dilemma that many founders that are trying to build ambitious change the world companies have, which is on whether to go horizontal in where you're really focusing first on building a modular extensible platform. But when you do that, investors will oftentimes say you need to focus or go vertical where you're focusing on a specific application. But then when you do that, investors are gonna say, "I don't know how big this gets. It seems like it's a pretty nichey product." How do you make that decision between a horizontal or vertical focus as your first move? - I think in the end it depends on the

market.

00:43:43,080 I know that sounds super unsatisfying, right? But you have to really understand the market dynamics and there's no one size fits all answer. I think like that's a question that we're thinking about. Should we focus on one specific protocol that the robot can do and just go after all pharma and biotech companies and academic labs that do one specific protocol? Or should we be building a robot that is extensible, generalizable, works with any protocol? And the truth is, it depends, right? Like if we go out there and we see actually yes, there are one or two protocols that almost everyone's using and it's a huge bottleneck, a huge pain point, we should focus on those two. But if we go out there and see it actually, scientists actually are all kind of doing different things then we have to see that and say, "Okay, actually it's time to invest in building that generalizability of our system to be able to go after different protocols." You can also think of it as in steps, right? Like maybe we go after one protocol first. It's not the the biggest market in the world, but it allows us to actually start working with customers and focus and we use that as a wedge, to keep going afterwards, to like learn about how we can generalize and we can build that generalizability as we work with more and more customers. So there are different ways to think about it. And again, there's no one size fits all. You have to really understand the market dynamics and really understand what your goal is and work backwards from there to be able to achieve that goal. - Fantastic. 00:45:29,970 Speaker Thank you Michelle for your talk.

00:45:32,580 It was indeed very inspiring. During the talk you spoke about longevity using robotics. I want to know like how do you see that? - For sure. 00:45:45,240 So Medra is a tool maker in essence. Our goal is to accelerate scientific progress by being able to help scientists and biologists be able to speed up the speed of their research. What's so exciting about biology in my opinion, is I think some of the biggest problems in the world right now can be solved with biology. I mean diseases is the very obvious one, right? Like if biologists are literally coming up with new vaccines and new cures to diseases. But other areas where I see biology can make a huge impact is climate change, is one, because there's actually a lot of biotech companies that are working on new biofuels, for example, that can replace fossil fuels. And longevity is an area where also there are a lot of very exciting companies that are founded by biologists or have wet labs that are trying to uncover what are the mechanisms that make us age and how can we actually be able to change that, right? And so we're not actually working on longevity, but we're empowering those companies and those scientists who want to work on longevity to be able to speed up their research. And I believe that we can like 10x the amount of research they can do, right? They're going to be able to 10x that speed of coming up with a new cure or a new drug or a new biofuel.

- Awesome. 00:47:25,050 So again, on that inspiring note, we're gonna draw this session of ETL to a close. Remember Medra, if you don't know it today, you'll know it soon. And gang, everybody, join me in thanking Michelle for sharing her experiences and insights with all of you, our students in Stanford's ETL course, MS&E 472, and our ETL viewers and listeners around the world. Next week gang, we'll be joined by Sarah Lamaison, the co-founder and CEO of Dioxycle. And you can find that event and other future events in this ETL series on our Stanford eCorner YouTube channel, and you'll find even more of our videos, podcasts, and articles about entrepreneurship and innovation at Stanford eCorner, that's ecorner.stanford.edu, thank you everybody. (upbeat music)..